EMJ MS

EUROPEAN MULTIDISCIPLINARY JOURNAL OF MODERN SCIENCE

https://emjms.academicjournal.io

Special Issue: Use of Modern Innovation on Integrated Research

Some Ways to Solve Irrational Equations

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Annotation: This article presents methods for solving some irrational equations encountered in solving Olympic problems.

Keywords: Olympic problems, irrational equations, linear equations, quadratic equations, result, discriminant.

Students have a deeper study of mathematics, in the process of solving the Olympiad, irrational equations. It also leads to solving various practical problems and solving similar equations. Special secondary education school programs included the topics related to solving the simplest irrational equations and their systems and the general methods of their solution. There are certain methods, algorithms are available to solve certain types of equations, such as primary linear equations, square and bulk equations, irrational equations. There are only separate types of irrational equations, that is, methods for resolving for some private points [2].

This article contains some methods of solving irrational equations.

We explain these methods through the following examples:

Example 1. $\sqrt{2+\sqrt{2-\sqrt{2+x}}}=x$ remove the equation.

Solving: Initially, we require conditions for the development of the identification. That is not a negative one, that is should not be negative $x \geq 0$. Also, the fact that $x \geq 0$, $\sqrt{2+x} \geq 0$ ensures that it is. Now requiring the conditional content of a second $2-\sqrt{2+x} \geq 0$ root expression ensures that the first root is also negative. We raise each side of equality to the square and formed in conjunction with the above conditions, and we come to solve the following system

[1]:

$$\begin{cases} x \geq 0 \\ 2-\sqrt{2+x} \geq 0 \\ 2+\sqrt{2-\sqrt{2+x}} = x^2 \end{cases} \quad \text{or} \quad \begin{cases} x \geq 0 \\ 2-\sqrt{2+x} \geq 0 \\ \sqrt{2-\sqrt{2+x}} = x^2 - 2 \end{cases}$$

Of this, $\begin{cases} x \ge 0 \\ 2 + x \le 0 \\ x^2 - 2 \ge 0 \\ 2 - \sqrt{2+x} = (x^2-2)^2 \end{cases}$ we will have a system and get the second and third solution in it and summarizing their solutions:

$$\begin{cases} x \ge 0 \\ x \le 2 \\ x \ge \sqrt{2} \\ 2 - (x^2-2)^2 = \sqrt{2+x} \end{cases}$$

From terms of system 1-3, $\sqrt{2} \le x \le 2$ or $\frac{\sqrt{2}}{2} \le \frac{x}{2} \le 1$ we form a condition and to solve the equation $\frac{x}{2} = \cos t$, we enter the appointment in the form of $0 \le t \le \frac{\pi}{4}$.

As a result, we get the following equation: $2 - (4\cos^2 t - 2)^2 = \sqrt{2 + 2\cos t}$ or $2 - 4(2\cos^2 t - 1)^2 = \sqrt{2+2\cos t}$. $2\cos^2 t = \cos 2t + 1$ since it is, $2 - 4\cos^2 2t = \sqrt{2 + 2\cos t}$ or $2(2\cos^2 2t - 1) = \sqrt{2+2\cos t}$ the equation comes from. By simplifying the left side of the equation $-2\cos 4t = \sqrt{2+2\cos t}$ we will have an equation in appearance, such is the $\cos 4t \le 0$ ва $\frac{\pi}{2} \le 4t \le \pi$, $\frac{\pi}{8} \le t \le \frac{\pi}{4}$. We raise both sides of the equation to the square and $4\cos^2 4t = 2 + 2\cos t$ or $2\cos^2 4t - 1 = \cos t$, $\cos 8t - \cos t = 0$ or $-2\sin\frac{7t}{2}\sin\frac{9t}{2}t = 0$ simply form a trigonometric equation and solve it: :

$\left[\begin{array}{l} \frac{7t}{2} = \pi n,\ \ n \in Z \\ \frac{9t}{2} = \pi k,\ \ k \in Z \end{array}\right.$ or $\left[\begin{array}{l} t = \frac{2\pi n}{7} = \pi n,\ \ n \in Z \\ t = \frac{2\pi k}{9} = \pi k,\ \ k \in Z \end{array}\right.$ we find solutions. It is well

known that, , $\frac{\pi}{8} \le t \le \frac{\pi}{4}$ from satisfying the condition, $\frac{\pi}{8} \le \frac{2\pi n}{7} \le \frac{\pi}{4}$, $\frac{7}{16} \le n \le \frac{7}{8}$ it turns out that n is a whole number, which means that the edge is the root. In the same way, check the other root and , $\frac{\pi}{8} \le \frac{2\pi k}{9} \le \frac{\pi}{4}$, $\frac{9}{16} \le k \le \frac{9}{8}$ and , we create. So for k=1,

$t=\dfrac{2\pi}{9}$ and in turn, $\dfrac{x}{2}=\cos\dfrac{2\pi k}{9}$, $\quad x=2\cos\dfrac{2\pi k}{9}$ we will have a solution.

Example 2. Remove $\sqrt[3]{x+24}+\sqrt{x+1}=5$ the equation.

Solving: For the given equation $x+1\geq 0, \quad x\geq -1$ by required the condition, $u=\sqrt[3]{x+24}, \; v=\sqrt{x+1}$ we enter the setting to resolve it, $x=u^3-24, \quad x=v^2-1$ and as a result, we come to solve the following system of the following equations: $\begin{cases} u+v=5 \\ u^3-24=v^2-1 \end{cases}$. We find v from the first equation in the system and *u* put it in the second equation, and we have a relatively the following equation: $u^3-24-(5-u)^2+1=0$. We simplify and simplify the parenthesis, and $u^3-u^2+10u-48=0$ we solve the equation in the form of the form. To solve this equation, we record it in the following view $u^3-3u^2+2u^2-6u+16u-48=0$ and we are grouped, resulting $u^2(u-3)+2u(u-3)+16(u-3)=0, \qquad (u-3)(u^2+2u+16)=0$ in the formation of an equation in the form. The resulting in the $u-3=0$ or $u=3$ formation of equation, as the disk of the equation generated through the second multiplier stems that it does not have a solution. So, $u=3$, $v=2$. We will find a solution to one of them by setting the value of these in the $\sqrt[3]{x+24}=3, \quad x+24=27, \quad x=3$ above - defined.

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